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Cahlen Brascheau # 154 HW #9

1)

$8m = 2^{23}$ $32 = 2^5$ $BF = \frac{2^{16}}{2^5} = 2^{11}$

$64K = 2^{16}$

a) 7 bits | 11 bits | 5 bits

| Tag | BF# | offset |

b) 23−m bits | m bits

| Tag | offset |

block size: 2^m

c) 9 bits | 8 bits | 6 bits

| tag | Set # | offset |

block size: 2^6

# of BF = $\frac{2^{16}}{2^6} = 2^{10}$

# of sets $\frac{2^{10}}{2^4} = 2^8$

2)

a) 3 bits | 3 bits | 4 bits

| Tag | BF# | offset |

Block size = 2^4

Main Mem = 16 x 64 = 1024 = 2^{10}

Cache size = 8 x 16 = 128 = 2^7

# of BF = $\frac{2^7}{2^4} = 2^3$

b) toBinary(37A) = 110 | 111 | 1010

Hit. Tag matches BF 7's tag.

c) toBinary(22C) = 1000 | 101 | 100

Hit. Tag matches BF 2's tag.

D) toBinary(1B9) = 0110 | 111 | 001

miss. tag doesn't match BF 3's tag.

3)

a) 4 bits | 2 bits | 4 bits
tag | Set # | offset

+1 Set size $\frac{2^3}{2^1} = 2^2$

B) 1101 | 11 | 1010 (3)
Hit. tag matches BF7 in S#3

C) 1000 | 10 | 1100 (2)
Hit. tag matches BF5 in set #2

D) 0110 | 11 | 1001 (3)
Hit. tag matches BF6 in Set #3

4)

Main Mem = 1M words = 2^{20}
Cache Size = 4K = $2^2 \times 2^{10} = 2^{12}$
Block size = 16 = 2^4
# of BF $\frac{2^{12}}{2^4} = 2^8$

SA: 10 bits | 6 bits | 4 bits
Tag | Set # | offset

DM: 8 bits | 8 bits | 4 bits
Tag | BF # | offset

FA: 16 bits | 4 bits
Tag | offset

A)

0x9491DA

1001 0100 / 1001 1101 / 1010
148 157

i) Cache Frame # 157
ii) Tag must be 148

B)

1001 0100 1001 1101 | 1010

i) Set # 29

ii) Tag = 10 bits

iii) 10 0101 0010 = 252

C)

1001 0100 1001 1101 | 1010

Tag = 9491D

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Main Mem = 32K = $2^5 \times 2^{10} = 2^{15}$ # of BF = $\frac{2^{12}}{2^3} = 2^9$

Cache size = 4K = $2^2 \times 2^{10} = 2^{12}$

Block size = 8 = 2^3

	12 Bits	3 bits
FA	tag	offset

a)

2^a comparators

b)

size = 12 bits

c)

	3 bits	9 bits	3 bits
DM	tag	BF #	offset

Tag = 3 bits

1 comparator needed.

# of sets = $\frac{2^9}{2^2} = 2^7$

6) # of BF = $\frac{2^{12}}{2^3} = 2^9$

Main Mem: 8K blocks: $2^3 \times 2^{10} \times 2^3 = 2^{16}$

Cache size: 512 blocks: $2^9 \times 2^3 = 2^{12}$

Block size = $8 = 2^3$

DM | Tag (4 bits) | BF # (9 bits) | offset (3 bits)

a) 16 bits

SA | Tag (6 bits) | Set # (7 bits) | offset (3 bits)

FA | Tag (13 bits) | offset (3 bits)

b)

CA49

1100 1010 0100 1001

Offset = 001

c)

1100 | 1010 0100 | 1001

i)

BF #329

ii)

1 comparator of width 4 bits

D)

1100 1010 0100 1001

i)

Set # 73

ii)

4 comparators, 6 bits wide

e)

i)

13 bits in each tag

ii)

2^4 Comparators, 13 bits wide.